

CLAIMS

1. A photonic crystal optical waveguide, comprising:
a optical waveguide portion having a core made of a photonic crystal
5 with a structure having a periodic refractive index in at least one direction perpendicular to a propagation direction of guided light and having a uniform refractive index in the propagation direction of the guided light, and a cladding arranged in contact with the core, in order to confine the guided light in the core; and
10 an incident-side phase modulation portion arranged in close proximity or in contact with an incident surface of the core.
2. The photonic crystal optical waveguide according to claim 1,
wherein there is a photonic band in the propagation direction of the
15 light in the core;
wherein the incident-side phase modulation portion phase-modulates incident guided light and lets it propagate through the core of the optical waveguide portion; and
wherein the core propagates all or at least half of the energy of the
20 phase-modulated guided light as a wave associated with higher-order photonic bands of said photonic bands.
3. The photonic crystal optical waveguide according to claim 1, wherein the incident-side phase modulation portion is a phase grating having a
25 refractive index period that is adjusted to the refractive index period of the core.
4. The photonic crystal optical waveguide according to claim 1, wherein the incident-side phase modulation portion is a phase grating having the
30 same structure as the core, and having the same refractive index period as the core.
5. The photonic crystal optical waveguide according to claim 1, wherein the incident-side phase modulation portion is a portion separated by cutting
35 an end portion vicinity on the incident surface side of the core.
6. The photonic crystal optical waveguide according to claim 2, wherein

the core lets a wave associated with the second coupled photonic band from the lowest order of the phase-modulated guided light propagate.

7. The photonic crystal optical waveguide according to claim 1, further comprising an emerging-side phase modulation portion arranged in close proximity or in contact with an emerging surface of the core from which the guided light emerges.

8. The photonic crystal optical waveguide according to claim 7, wherein the emerging-side phase modulation portion converts the light emerging from the emerging surface of the core into a plane wave.

9. The photonic crystal optical waveguide according to claim 7, wherein the emerging-side phase modulation portion is a phase grating having a refractive index period that is adjusted to the refractive index period of the core.

10. The photonic crystal optical waveguide according to claim 7, wherein the emerging-side phase modulation portion is a phase grating having the same structure as the core, and having the same refractive index period as the core.

11. The photonic crystal optical waveguide according to claim 7, wherein the emerging-side phase modulation portion is a portion separated by cutting an end portion vicinity on the emerging surface side of the core.

12. The photonic crystal optical waveguide according to claim 1, wherein the cladding is made of a photonic crystal having a periodic refractive index in at least one direction perpendicular to a propagation direction of the guided light and having a uniform refractive index in the propagation direction of the guided light.

13. The photonic crystal optical waveguide according to claim 1, wherein the core comprises an active material having an optical non-linear effect.

14. The photonic crystal optical waveguide according to claim 1, wherein the core is made of a multilayer film layer having a periodic refractive index

in one or two directions perpendicular to the propagation direction of the guided light and having a uniform refractive index in the propagation direction of the guided light.

5 15. The photonic crystal optical waveguide according to claim 12, wherein the optical waveguide portion has a fiber shape with a substantially circular cross section, and the core is fiber-shaped with the cladding formed around the core; and

10 wherein the core and the cladding have a uniform refractive index in the propagation direction of the guided light.

16. The photonic crystal optical waveguide according to claim 15, wherein the refractive index periods of the core and the cladding are symmetric with respect to the center axis of the optical waveguide portion, 15 which is parallel to the propagation direction of the guided light.

17. The photonic crystal optical waveguide according to claim 16, wherein the optical waveguide portion comprises a fiber-shaped homogenous substance with a substantially circular cross section, a plurality of cavities 20 are formed in the homogenous substance along its longitudinal direction, and the plurality of cavities are formed symmetric to the center axis of the optical waveguide portion, which is parallel to the propagation direction of the guided light.

25 18. The photonic crystal optical waveguide according to claim 17, wherein all or some of the cavities are filled with a fluid substance.

19. The photonic crystal optical waveguide according to claim 16, wherein the refractive index in the cross section of the optical waveguide 30 portion changes periodically and in concentric circles with respect to a distance from the center axis of the optical waveguide portion, which is parallel to the propagation direction of the guided light.